Spectroscopic studies of impurity-helium condensates containing stabilized N and O atoms

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We present optical spectra of impurity-helium condensates during the process of formation by injection of gas mixtures N_2–Rg–He (Rg=Ne, Kr) into bulk superfluid helium after passing through an rf discharge. Atomic lines of He, Rg, N, O atoms and N_2 bands (1^+ and 2^+) are present in the spectral range 320–1100 nm studied in these experiments. We also studied spectra emitted by the samples during their destruction, stimulated by warming through the temperature range 1.5–15 K. The most intense features of emission spectra of the N–N_2–He and N–N_2–Ne–He samples during their destruction were α- and β-groups (corresponding to transitions N(^{2}D–^{4}S) and O(^{1}D–^{1}S). For the N–N_2–Ne–He sample the transformation of the α-group spectra was detected: at the onset of sample destruction, the α-group spectra were similar to those of N atoms in Ne matrices, but as time progressed the spectra became similar to that of N atoms in N_2 matrices. In the emission spectra of the N–N_2–Kr–He samples the intense β-group of O atoms and M-bands of NO molecules were found. Differences in the spectra obtained during destruction of N–N_2–Ne–He and N–N_2–Kr–He samples may be explained by a different shell structure of the nanoclusters formed during impurity-helium condensate preparation.